



Test Method T631

Wet coring of road construction materials

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About this release

Title:	Wet coring of road construction materials
Test method number:	T631
Author:	Materials Technology
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Summary of changes

Issue number	Clause number	Revision description	Authorised by	Publication date
Issue 4.0	All	Updated test method title and reformatted template.	Director Pavements and Geotechnical	21 April 2020
	Various	Removed clauses relating to dry coring, refer to Transport for NSW test method T632.		
	Various 7	Added new clauses for concrete coring. Added new clause for references.		
Ed 3 / Rev 0	All	Reformatted template	J. Friedrich	November 2012
Ed 2 / Rev 0		New Issue. Incorporate wet & dry requirements. Diagrams removed. Title Revised	D. Hazell	January 2009
Ed 1 / Rev 0		Reformatted and Revision Summary Added	D. Dash	January 2000

Note: The functions of the former State Government agency Roads and Maritime Services (RMS or Roads and Maritime) are now administered by Transport for NSW.

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Test Method T631

Wet coring of road construction materials

1 Scope

This test method sets out the procedure for wet coring of road construction material.

2 General

- (a) The method is applicable to road construction materials that have gained adequate compressive or tensile strength and includes the following materials:
 - (i) Asphalt.
 - (ii) Material blended with cementitious and/or bituminous binders.
 - (iii) Concrete (with or without the presence of supplementary cementitious materials such as fly ash, slag cement, silica fume, etc.).

NOTE: Specimens are sampled from a representative area unless otherwise specified.

- (b) For coring concrete, specific additional steps are required in Clause 5.3 of this procedure. These steps are referenced from AS 1012.14.
- (c) Unless otherwise specified, the wet coring technique is to be used.

NOTE: Wet coring is generally used for materials with compressive strength ≥ 5 MPa. However, for lower strength materials dry coring (Transport for NSW Test Method T632) is used to minimise damage to the core.

- (d) The diameter of core must comply with the specification or subsequent test requirements (e.g. the maximum particle size $< \frac{1}{3}$ diameter of core, consistent size of sample).

NOTE: For asphalt, core samples for determination of bulk density must not be less than 95 mm diameter.

- (e) Trimming
 - (i) For concrete cores, follow the trimming procedure in AS 1012.14.
 - (ii) For asphalt and foamed bitumen stabilised, trimming is not required. See relevant asphalt or foamed bitumen material test methods for trimming requirements.

3 Apparatus

The following apparatus is required:

- (a) Coring machine fitted with:

- (i) A motor-driven head, a core barrel attachment of appropriate diameter and system for cooling and flushing the bit.
 - (ii) An anchoring mechanism that will prevent the corer from spinning.
- (b) Thin wall diamond tipped bits of the appropriate type for the material being cored with internal diameters to suit the specified diameter of specimen to test (e.g. 50, 75, 100 or 150 mm).
 - (c) For coring concrete, a diamond or silicon-carbide cutting edge saw for trimming ends of cores.

NOTE: The cutting edge saw is used for trimming, this activity may be conducted in the laboratory.

- (d) A source of cooling medium:
 - (i) Potable water for wet coring, or
 - (ii) Dry ice or liquid nitrogen and application system for hot asphalt at a temperature above 40 °C.
- (e) Containment system appropriate to the cooling medium.
- (f) Runoff containment system with sufficient capacity, to capture cooling medium and drilling returns during coring.
- (g) Core lifter to remove the core without damage.

NOTE: A suitable design is a cylindrical clamp or a steel wire of appropriate length with a diameter that will fit into the space between the core and the material and be strong enough to lift the core. The wire should have a 90° bend to form a handle and a 90° bend at the bottom lift the core.

NOTE: Screwdrivers, chisels or other tools maybe used to assist with the loosening of a core specimen but must not damage the specimen nor such tools shall be used to extrude a specimen.

- (h) Hammer.
- (i) Sealable container to protect the core from damage and moisture loss during transport. An insulated and cooled container is required for transporting asphalt samples in hot weather.
- (j) For asphalt pavements a thermometer for measuring surface temperature.
- (k) A calibrated measuring device readable to 1 mm for field measurements of core length and diameter.
- (l) Vernier callipers readable to 0.2 mm for measuring core diameter.

4 Preparation

- (a) Mark out the sampling pattern for the test points over the surface to be tested systematically. Record the location of each test point.

NOTE: Sampling pattern to be determined by specifier.

NOTE: For concrete, avoid embedded reinforcement. Whenever possible, locate the reinforcement with a calibrated cover meter, ground penetrating radar or other suitable device and where available referencing to as-built drawings.

(b) For asphalt cores:

(i) Mark each test point with an arrow in the direction of traffic flow.

NOTE: The marking must remain intact during the procedure.

(ii) Ensure the asphalt at the test point and for at least 40 mm wider than the diameter of the core is less than 40 °C. Where asphalt is hotter than 40 °C, cool the area using one of the following methods:

- Dry ice to be placed on the area.

NOTE: An initial thickness of 75 mm for at least 20 minutes. Thinner layers may need less time to cool.

- Liquid nitrogen to be applied to the area.

(c) For concrete cores or materials blended with cementitious and/or bituminous binders:

(i) Mark each test point with the top or outer surface end.

5 Procedure

5.1 Drilling

(a) At the test point, set up the equipment to be perpendicular to the test surface. The sample must form a right cylinder with the top and bottom perpendicular to the axis.

NOTE: However, where cores are required for strength testing relocate to an adjacent site if cracking is detected. Avoid formed joints, edges of a concrete element or other areas which may reduce the representative nature of the core.

(b) Attach the appropriate diameter thin wall bit.

(c) Connect the cooling system. For asphalt with a temperature 40 °C or hotter, chill the cooling medium during the coring operation so that the material being cored is cooled to a temperature less than 40 °C. For concrete, apply water to the cutting edge during the drilling process.

NOTE: Ice can be used to cool the water or air supply.

(d) Install the containment system to capture drilling returns and minimise any control runoff.

(e) Start the coring machine and operate it in accordance with the operating procedures so that the sample will not be weakened by shock or by heating.

(f) Carefully lower the bit to just above the surface.

- (g) Turn on and regulate the cooling medium.
- (h) Commence coring by applying even and continuous downward pressure. Avoid overheating and jamming the barrel.
- (i) Minimise lifting and replacing a bit to avoid producing corrugations on the core.

NOTE: Use only the minimum amount of cooling medium to cool the bit, lubricate or remove fine particles from around the bit, and prevent eroding the sample.

NOTE: Avoid applying excessive pressure to the handle of the machine that may cause the core drill-stand to lift off the ground.

- (j) Core to the required depth in one continuous motion. Ensure that the angle of cut does not change during coring. Unless otherwise specified, drill further than the desired core length to ensure achieving an adequate core length for testing.

NOTE: The full depth of bound layer is recommended.

5.2 Core extraction

- (a) When the required depth has been reached or if the core breaks:
 - (i) Turn off the cooling medium and stop the core drill.
 - (ii) Withdraw the bit from the hole.
 - (iii) Remove the core without distorting or damaging the core.

NOTE: If the core is bonded to an underlying layer of material insert the core lifter between the core and the wall of the core and lever the core carefully so as to avoid damaging the core. If the core refuses to release then re-commence cutting to a depth where release can be obtained. If the core still fails to release cut an adjacent hole so that a new angle of leverage can be applied to the core.

NOTE: To remove cores in the barrel, lightly tap the outside of the core barrel with a hammer. If the core remains in the pavement, use a core removal device.

- (b) Place samples on their side on a smooth horizontal surface.
- (c) Mark each core with a unique sample identification number and reinstate markings on the top of the core if markings were removed during coring. For asphalt cores also mark the direction of traffic.

5.3 Inspecting

- (a) Inspect each hole and note if any core material is remaining in the hole. If a full depth core is required and the core has broken, remove remaining material in the hole to obtain layer thickness. Measure the depth of the hole and record as total layer depth.

- (b) In the field, inspect each core and note the following:
- (i) Measure the length of the complete core to the nearest 1 mm. If the core is uneven, record both the minimum and maximum length.
 - (ii) Measure the diameter to the nearest 1 mm.

Note: Prior to testing concrete cores, measure and record two diameters taken at right angles to each other, near each end, and near the centre of the core, to the nearest 0.2 mm. Calculate the average diameter at each location.

- (iii) Layers present in the core if possible. Identify, mark and measure the thicknesses of each layer to nearest 1 mm.

NOTE: For asphalt cores, detailed core logging may be conducted in the laboratory.

- (iv) Particles with any dimension $> \frac{1}{3}$ the diameter of core.
- (v) Any defects (e.g. cracks, voids, attrition, steel reinforcement, laminations, geotextile, foreign inclusion, clay lumps, unmixed binder).

NOTE: Carefully handle the cores to avoid damage. After inspecting each core, reject any core which has been damaged by poor coring or extraction techniques and take a second core to replace the rejected core. Do not reject any cores with defects that relates to material quality or construction issues such as poor compaction, visible construction damage, significant voids (with exception of no fines concrete or open grade asphalt) or cracks, broken edges, irregular dimensions, reinforcing steel, etc., may affect their strength.

- (c) Secure the core in the sealed container and ensure the core is not damaged in transit and does not dry out.

NOTE: For asphalt cores during hot weather, use an insulated and cooled container.

- (d) Where a core is required for strength testing and is unsuitable (e.g. cracking, crumbles), relocate to an adjacent location and repeat Clause 5.

- (e) Repair the test hole.

NOTE: The repair is cement or bitumen based dense graded material, compacted to provide similar strength to the pavement and provide a waterproof capping.

5.4 Trimming

NOTE: This activity may be conducted by the laboratory.

NOTE: Asphalt and foamed bitumen stabilised core trimming is not required for this method. See relevant asphalt or foamed bitumen material test methods for trimming requirements.

- (a) For concrete cores, follow the trimming procedure in AS 1012.14.

- (b) For road construction materials blended with cementitious materials and/or bituminous binders to be tested for unconfined compressive strength (UCS), a diameter of 100 mm with the requirement of 1:1 L/d should be followed.

6 Reporting

Include the following information, data and results in the report:

- (a) Client.
- (b) Unique sample identification number.
- (c) Date and time of core was taken.
- (d) Location of sample (i.e. chainage and offset).
- (e) Description of material.

NOTE: For asphalt material, record in the notes, number of layers; mix type and nominal mix size for each layer present.

- (f) Nominal diameter of core.
- (g) Total layer depth, to the nearest 10 mm if full depth core has not been obtained.
- (h) Results from each inspection in Clause 5.3 (b):
 - (i) Length of core to nearest 1 mm. The minimum and maximum length for uneven cores to nearest 1 mm.
 - (ii) Layers and thicknesses to nearest 1 mm.
 - (iii) Diameter to nearest 0.2 mm for concrete cores, and nearest 1 mm for all other cores.
 - (iv) Particles > 1/3 the diameter of core.
 - (v) Defects.
- (i) Reference to this test method.

7 References

The following documents are referred to in this test method:

- AS 1012.14 (2018). “Methods of testing concrete, Method 14: Method for securing and testing cores from hardened concrete for compressive strength and mass per unit volume.” Standards Australia
- T632 (2020). “Dry coring of road construction material.” Transport for NSW.

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Contact Us:

If you have any questions or would like more information on this document please contact Transport for NSW:



roads-maritime.transport.nsw.gov.au



techinfo@transport.nsw.gov.au



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Customer feedback
Locked Bag 928,
North Sydney NSW 2059



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